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TRANSLATIONS

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AND

THE RULES MADE THEREUNDER

I, Janet Powell, B.A., M.I.T.I., translator to Messrs. Taylor and Meyer, of 29 Kingsmead Road, London SW2 3HY, declare that I am conversant with the German and English languages and that to the best of my knowledge and belief the accompanying text is a true translation of the text on which the European Patent Office has granted or intends to grant European Patent Number 0482282 in the name of METZELER GIMETALL AG.

Signed this 27th day of August 1993

J. Powell
....

The invention relates to an axial bush bearing, in particular for motor vehicles, with an outer sleeve and a central pin bearing conical cores, between which sleeve and pin at least one rubber member, which absorbs axial forces, is gripped.

A bush bearing of this kind is known from the FR-2 285 550. In this case the rubber member is firmly gripped between the outer sleeve and the pin with the conical cores, with additional axial movements being limited by ring discs projecting radially from the pin. The result is a relatively hard bush bearing which has relatively little freedom of movement in the axial and radial directions and cannot therefore adequately isolate vibrations.

A similar bush bearing is known from the GB 434 583, in which two rubber members are arranged on a cylindrical pin and are in each case supported between a collar on the pin and tapered end walls of the outer sleeve or between two stops on the pin and a central taper of the outer sleeve. In order to achieve a certain progressiveness of response, the rubber members have a cross section which is approximately in the form of a parallelogram, although they are also firmly gripped between the pin and the outer sleeve. Here too the vibrations are inadequately isolated.

In contrast, the object of the present invention is to develop a bush bearing of this kind such that it can absorb axial forces and axial vibrations sufficiently smoothly and at the same time can serve in particular as a torque support in motor vehicle engines so as to limit movements of the engine. A particular aim is to provide a torque support of this kind which guarantees that structure-borne sound is insulated upon impact, in particular in the case of load cycle changes, i.e. to make a bearing of this kind capable of absorbing axial forces in both directions, while largely minimising the transmission of structure-borne sound.

In order to solve this object, according to the invention two rubber members having hollow conical inner surfaces are bonded to the conical cores with their conical surfaces directed towards one another and in the case of an axial displacement are supported against at least one annular wall which is connected to the outer sleeve and projects radially inwards from the latter.

In this respect it is advantageous for the rubber members with hollow conical inner surfaces to have a cylindrical outer surface and be guided with clearance inside the outer sleeve.

On account of this formation of two rubber members which are directed towards one another and are formed and supported in a corresponding manner, there is a continuous transition from a softer spring stiffness to a harder spring stiffness in the axial spring characteristic when the engine torque causes a rubber member to come to bear against an annular wall, so that the transmission of structure-borne sound is reduced when shock loads occur.

The conical cores may be secured to the pin with their cone vertices directed towards one another, and the annular wall may extend as a central wall in the outer sleeve, against which wall the rubber members are supported by way of their wider bases.

It is, however, also possible for the conical cores to be secured to the pin with their cone bases directed towards one another, with a respective annular wall, which projects radially inwards, being provided at the two axial ends of the outer sleeve, against which walls the rubber members are supported by way of their wider bases.

It is advantageous for the rubber members to comprise elevations on their end faces which are adjacent to the annular walls, which elevations define a minimum spacing from

the central wall whereby the spring characteristic can be further influenced, particularly in the primary range.

The cores may be supported at a central collar, which defines the minimum spacing of the rubber members, of the central pin, in which case they are secured against one another via sleeves which are screwed onto the pin ends.

It is, however, also possible for the rubber members to have a conical inner surface and a conical outer surface.

In this case the rubber members may then be sealed off from the outer sleeve at their base and the free space between the outer sleeve and the conical outer surface of the rubber members filled with a highly viscous liquid, the two liquid chambers communicating with one another via axial bores in the annular central wall.

Satisfactory damping of the shock movement is thus additionally possible, and the spring characteristic under tension or compression can be altered via the size of these axial bores.

For the purpose of further adjustment of the S-shaped spring characteristic, the outer cones of the two cores - and thus the rubber members - may have different angles.

The spring stiffness of the two rubber members may also be different.

These two measures, either individually or in combination, enable the behaviour of the two branches of the S-shaped spring characteristic to differ, which means that the axial forces occurring can be supported with a different characteristic in each direction.

The structure and the operating mode of embodiments according to the invention are explained in detail on the basis of diagrammatic drawings, in which:

Figure 1 is a longitudinal section through a bush bearing with cylindrical rubber members and conical cores, which are secured in place with their vertices directed towards one another,

Figure 2 is a longitudinal section through a similar bearing with additional damping liquid chambers and

Figure 3 is a longitudinal section through a bush bearing whose cores are secured in place with their cone bases against one another.

As can be seen in Figure 1, the bush bearing comprises a cylindrical outer sleeve 1 with an annular central wall 2, which projects radially inwards and extends over approximately one quarter to one third of the diameter. Conical, metallic cores 5 and 6 are placed from both sides with their vertices towards one another over a centrally guided pin 3 with a central collar 4, the width of which is approximately the same as that of the central wall 2, and secured against one another by means of a respective nut 7 and sleeve 8 screwed onto the ends of the pin 3. Rotationally symmetrical rubber members 10 and 11 are externally bonded to the metallic cores 5 and 6, each of which members has a hollow conical inner surface 12 and 13, respectively, corresponding to the inclination of the cores 5 and 6, and a cylindrical outer surface 14 and 15, respectively, which surfaces 14, 15 are slightly smaller than the inside diameter 16 of the sleeve 1.

On their end faces which are adjacent to the central wall 2 the rubber members 10 and 11 bear bosses or annular elevations 18 and 19 which define a predetermined spacing from the end faces of the rubber members 10 and 11.

If the pin 3 is axially deflected, one of the rubber members 10 and 11, according to the direction of displacement, is progressively compressed between the corresponding core 5 or 6 and the central wall 2, with a continuous transition taking place from a softer initial spring stiffness to a harder final spring stiffness in the axial spring characteristic of the rubber members 10 and 11 on account of the increasing compression. If a bush bearing of this kind is arranged as a torque support between an engine and the body of the vehicle, axial loads of this kind occur in both directions and usually as sudden shock loads. These shocks can in the first place be absorbed relatively smoothly by the formation of the bush bearing, so that the transmission of structure-borne sound is greatly reduced.

The formation of the bush at the same time permits sufficiently great universal movements if the bush is simultaneously subjected to forces in the radial and in the axial direction.

It is, however, also possible for the bush to have a characteristic which differs according to the direction of the effective axial force. This can be achieved by selecting different cone angles α and β ,so that the behaviour of the compression and thus of the spring characteristic differs according to the direction of action of the force. It is instead or additionally possible to use rubber members 10 and 11 of differing spring stiffness, so as thus to obtain a different behaviour of the two branches of the spring characteristic.

A bush according to the embodiment of Figure 2 permits additional damping of occurring shock loads. In this case the two rubber members 20 and 21 have both a conical inner surface 22 and 23 and a conical outer surface 24 and 25. The annular spaces 26 and 27 which are thus produced between the rubber members 20 and 21 and the outer sleeve 1 are then filled with

a highly viscous liquid which can pass via bores 28 in the central wall 2 from one chamber 26 into the other chamber 27. The rubber members 20 and 21 must of course be secured at their base against the outer sleeve 1 via seals 29 and 30 in order to prevent the liquid from leaking out.

This enables shock movements to be additionally damped, so that the spring characteristic under tension or compression can be altered by altering the diameter of the bores 28, which may also be formed as appropriate gaps, in the central wall 2.

However it is in principle also possible to fit the cores and rubber members in the reverse manner, as shown in Figure 3. According to this the conical cores 31 and 32 are secured with their wider bases directly against one another by the nut 7 and sleeve 8, which are screwed axially onto the pin 3. The correspondingly mounted rubber members 33 and 34 now bear against one another at the centre by way of their narrower end faces 35 and 36. Since, however, when they are in this fitted position the inside diameter of the rubber members 33 and 34 decreases outwards and they therefore become denser in this direction and are no longer directly secured by the cores, annular walls 37 and 38, which are attached to the outer sleeve 1, are provided at the outer end faces, against which walls the rubber members 33 and 34 are supported by way of their wider bases 39 and 40.

The rubber members 33 and 34 are here moulded in the same manner by way of their conical inner surfaces 41 and 42 onto the cores 31 and 32 and guided with clearance by way of their cylindrical outer surfaces 14 and 15 in the sleeve 1.

The operating mode is on the whole the same as that of the axial bush bearing according to Figure 1.

The overall result, therefore, is bush bearings with axial uncoupling which only take up a small installation space and

enable any desired spring characteristic to be obtained, from the lowest possible primary stiffness to a highly progressive stiffness behaviour.

It has also emerged that, particularly when used as torque supports, relatively expensive radial bushes can be replaced by axial bushes of this kind which make the connection process easier and require less space.

Claims

1. Axial bush bearing, in particular for motor vehicles, with an outer sleeve and a central pin bearing conical cores, between which sleeve and pin at least one rubber member, which absorbs axial forces, is gripped, characterised in that two rubber members (10, 11; 20, 21; 33, 34) having hollow conical inner surfaces (12, 13; 22, 23; 41, 42) are bonded to the conical cores (5, 6; 31, 32) with their conical surfaces directed towards one another and in the case of an axial displacement are supported against at least one annular wall (2; 37, 38) which is connected to the outer sleeve (1) and projects radially inwards from the latter.

2. Axial bush bearing according to claim 1, characterised in that the rubber members (10, 11; 33, 34) with hollow conical inner surfaces (12, 13; 41, 42) have a cylindrical outer surface (14, 15) and are guided with clearance inside the outer sleeve (1).

3. Axial bush bearing according to claims 1 and 2, characterised in that the conical cores (5, 6) are secured to the pin (3) with their cone vertices directed towards one another, and the annular wall (2) extends as a central wall in the outer sleeve (1), against which wall the rubber members (10, 11) are supported by way of their wider bases.

4. Axial bush bearing according to claims 1 and 2, characterised in that the conical cores (31, 32) are secured to the pin (3) with their cone bases directed towards one another, and that a respective annular wall (37, 38), which projects radially inwards, is provided at the two axial ends of the outer sleeve (1), against which walls the rubber members (33, 34) are supported by way of their wider bases (39, 40).

5. Axial bush bearing according to claim 3 or 4, characterised in that the rubber members (10, 11; 20, 21; 33, 34) comprise elevations (18, 19) on their end faces which are adjacent to the annular walls (2; 37, 38), which elevations define a minimum spacing from the annular walls (2; 37, 38).

6. Axial bush bearing according to claim 3, characterised in that the cores (5, 6) are supported at a central collar (4), which defines the minimum spacing of the rubber members (10, 11; 20, 21), of the central pin (3).

7. Axial bush bearing according to claim 3 or 4, characterised in that the cores (5, 6; 31, 32) are secured against one another via sleeves (7, 8) which are screwed onto the ends of the pin (3).

8. Axial bush bearing according to claim 1, characterised in that the rubber members (20, 21) have conical inner surfaces (22, 23) and conical outer surfaces (24, 25).

9. Axial bush bearing according to claim 8, characterised in that the rubber members (20, 21) are sealed off (29, 30) from the outer sleeve (1) at their base and the free space (26, 27) between the outer sleeve (1) and the conical outer surfaces (24, 25) of the rubber members (20, 21) is filled with a highly viscous liquid, the two liquid chambers (26, 27) communicating with one another via axial bores (28) in the annular central wall (2).

10. Axial bush bearing according to one or more of claims 1 to 9, characterised in that the outer cones of the two cores (5, 6; 31, 32) have different angles (α, β).

11. Axial bush bearing according to one or more of claims 1 to 10, characterised in that the spring stiffness of the two rubber members (10, 11; 20, 21; 33, 34) is different.

Fig.1

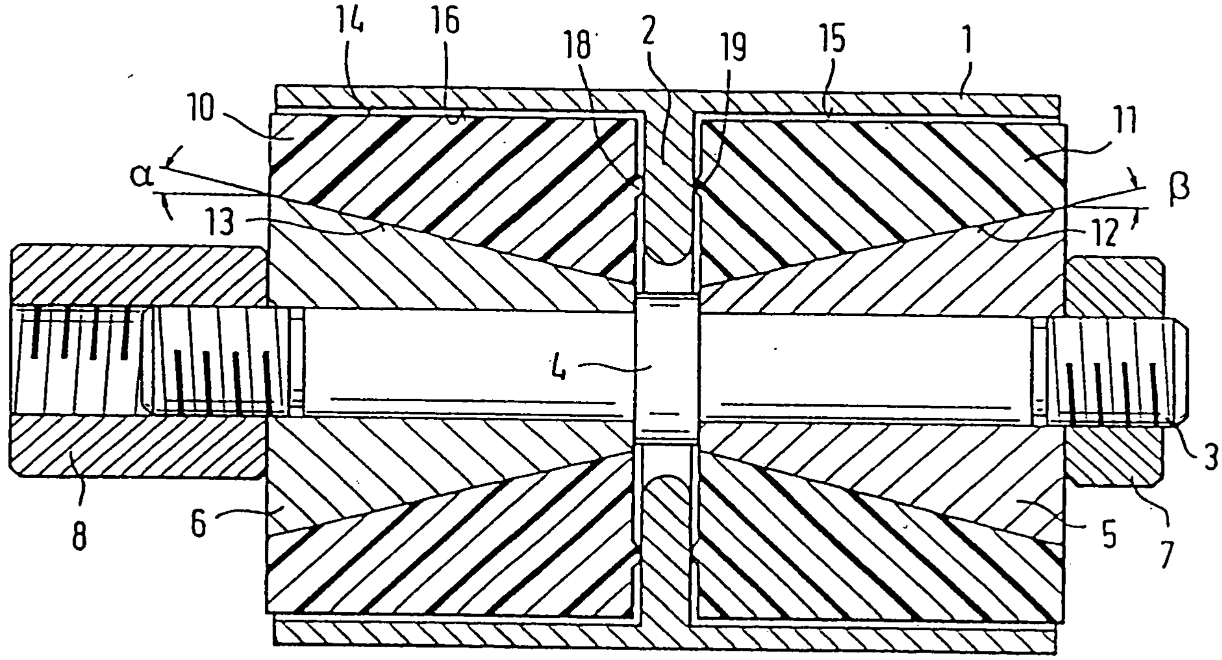
14
16
18
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Fig.2

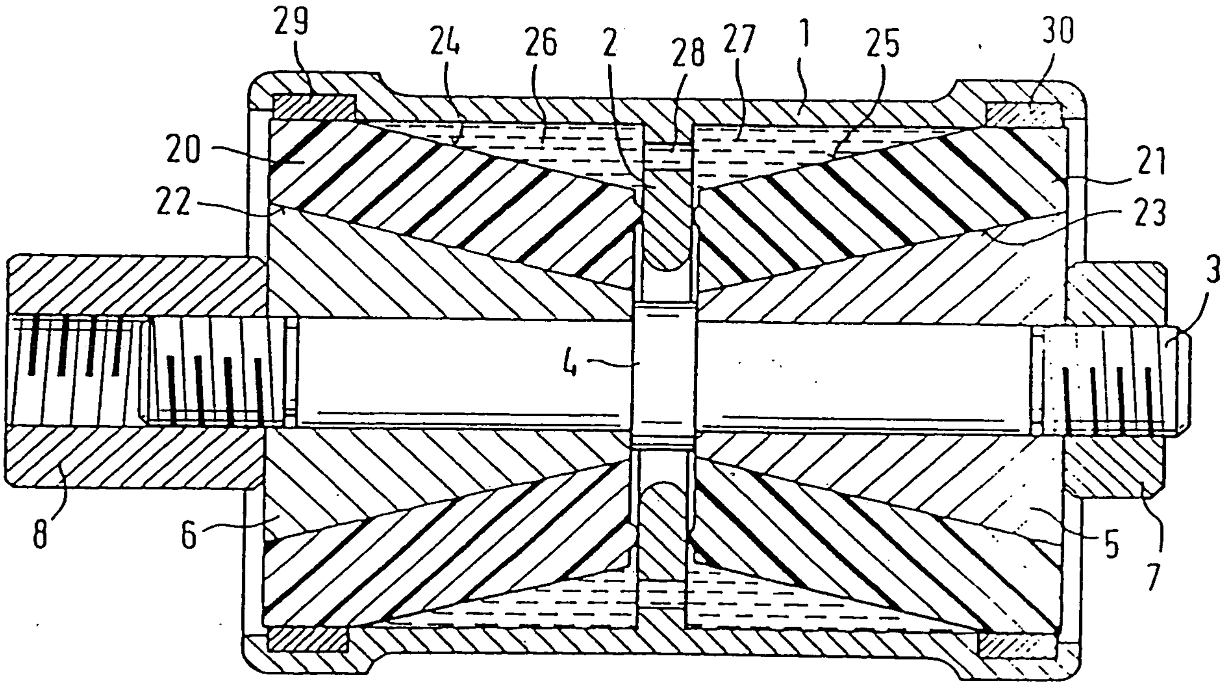
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Fig.3